

# Yuma Area Efforts Update

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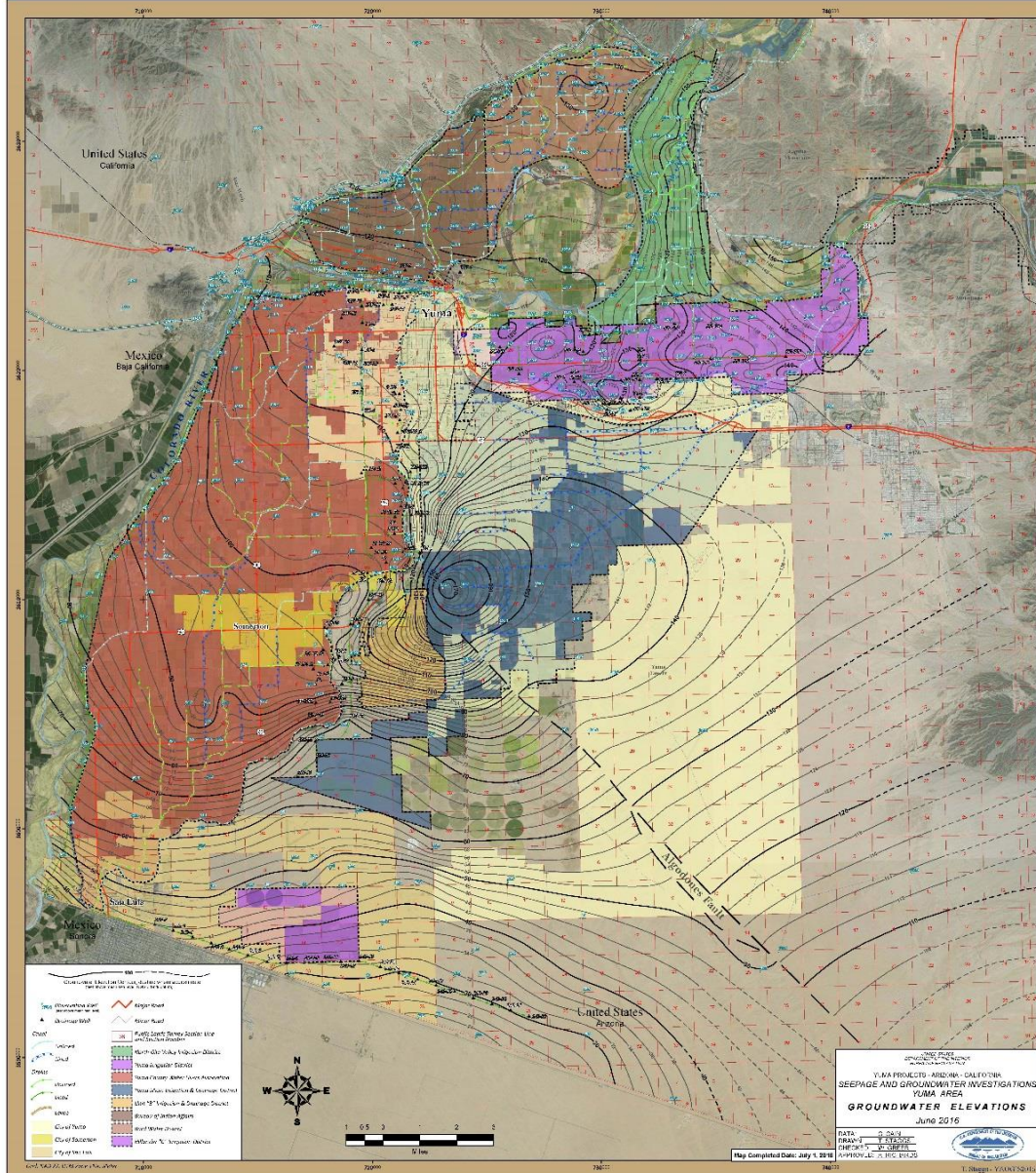
April 23, 2018

# Goals for Yuma Area Desalination/GW Investigations

- Provide new information to support the Governor's Water Augmentation Council (GWAC) Desalination Committee discussions
- Facilitate discussions to reduce system losses impacting Lake Mead
- Support efforts to reduce the risks of shortage on the Colorado River system
- Support efforts to develop new water supply opportunities, only with and through the cooperation of local interests and Reclamation

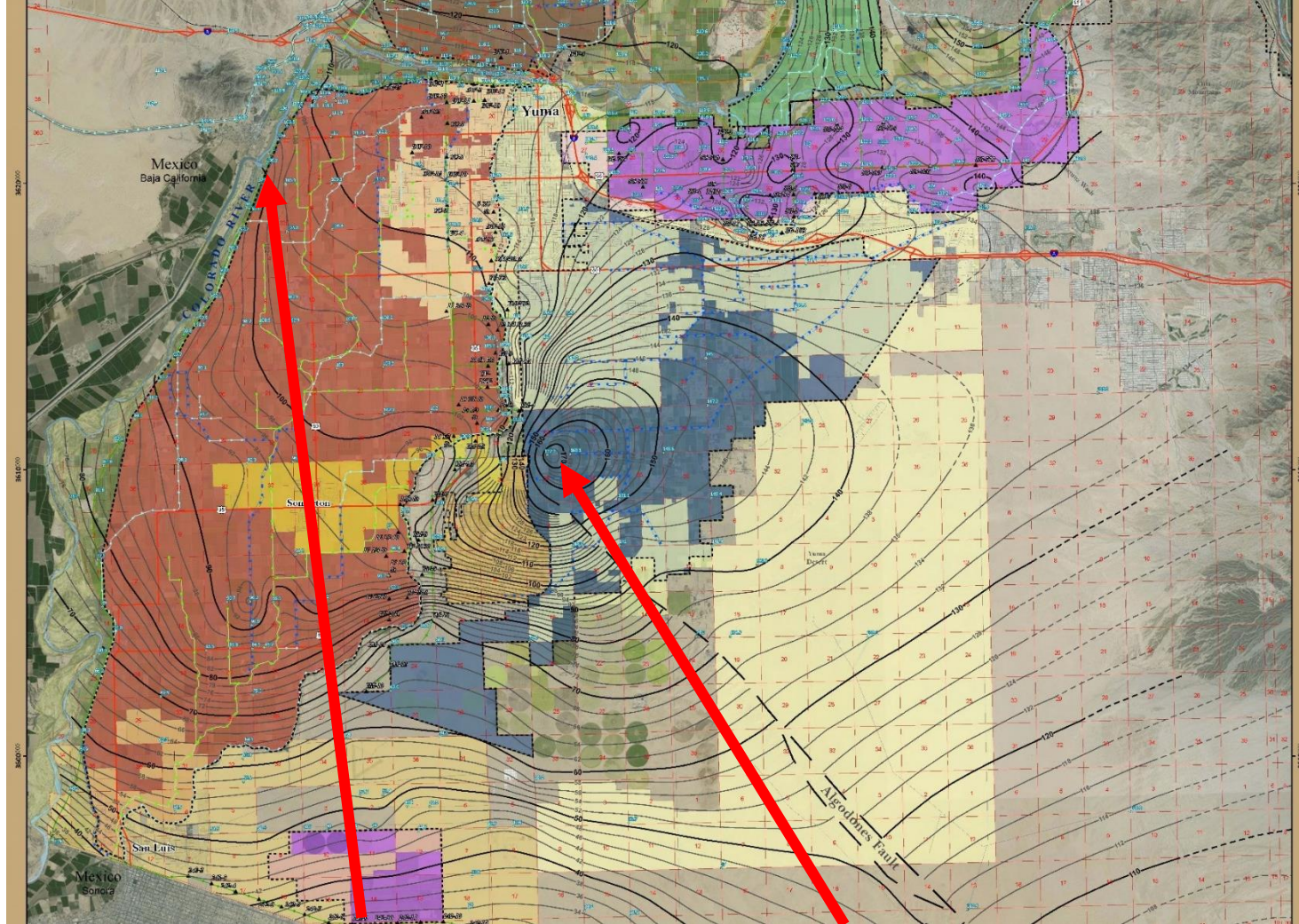
# Summary of Investigations

- Central question:
  - What is the range of opportunities to develop brackish groundwater under Yuma Mesa (aka the Mound) as a new water supply resource through desalination?
- Investigation Components:
  - Groundwater model to estimate the potential sustainable yield of groundwater extraction beneath the Mound (B&V Study)
  - Extraction well field and conveyance, and desalination process conceptual design (CH2M Study)
- Summary of Results:
  - Sustainable yield of Mound ~ 50 kaf/yr
  - Extraction and brackish groundwater desalination ~\$550/af
  - Opportunity for local delivery and exchange





# Yuma Area GW Elevations



**Morelos Dam  
(112 ft amsl)  
GW ~10-12 ft bgs**

**Yuma Mesa  
(213 ft amsl)  
GW ~40 ft bgs**

# Well Field

*Black & Veatch, 2016 (MODFLOW)*

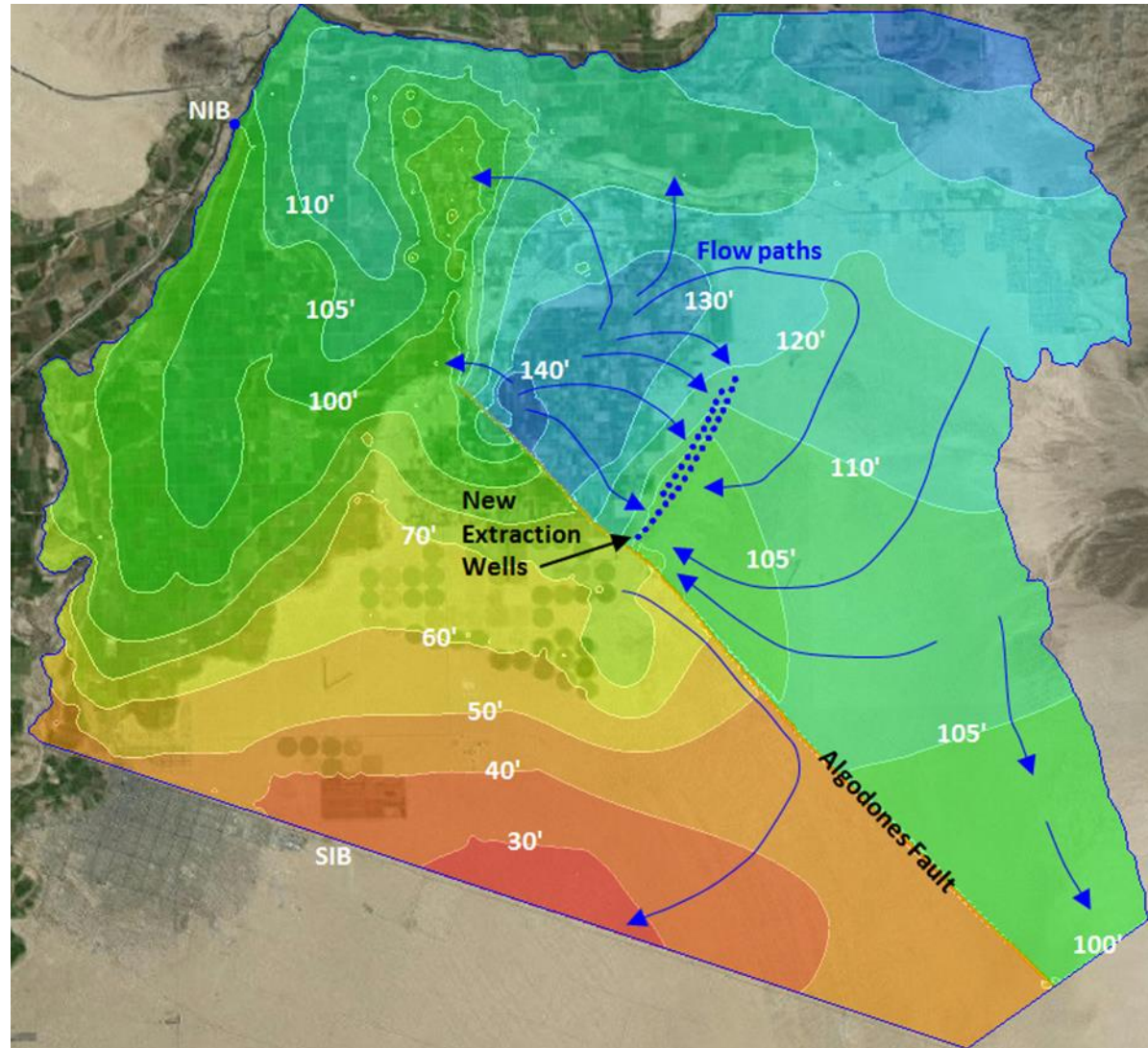
- Estimated Yuma Mesa GW Mound volume = 600 KAF (*USGS, 2006*)
- 30-40 extraction wells
- Average extraction rate of 1,000-1,100 gpm
- 50,000 AF/yr on a sustainable basis

*CH2M, 2017 (Pre-feasibility study: COST)*

- 19 extraction wells
- Extraction rate revised to 2,000 gpm (USBR)
- 50,000 AF/yr yield
- Conceptual well field site



# Transient Test Modeling results



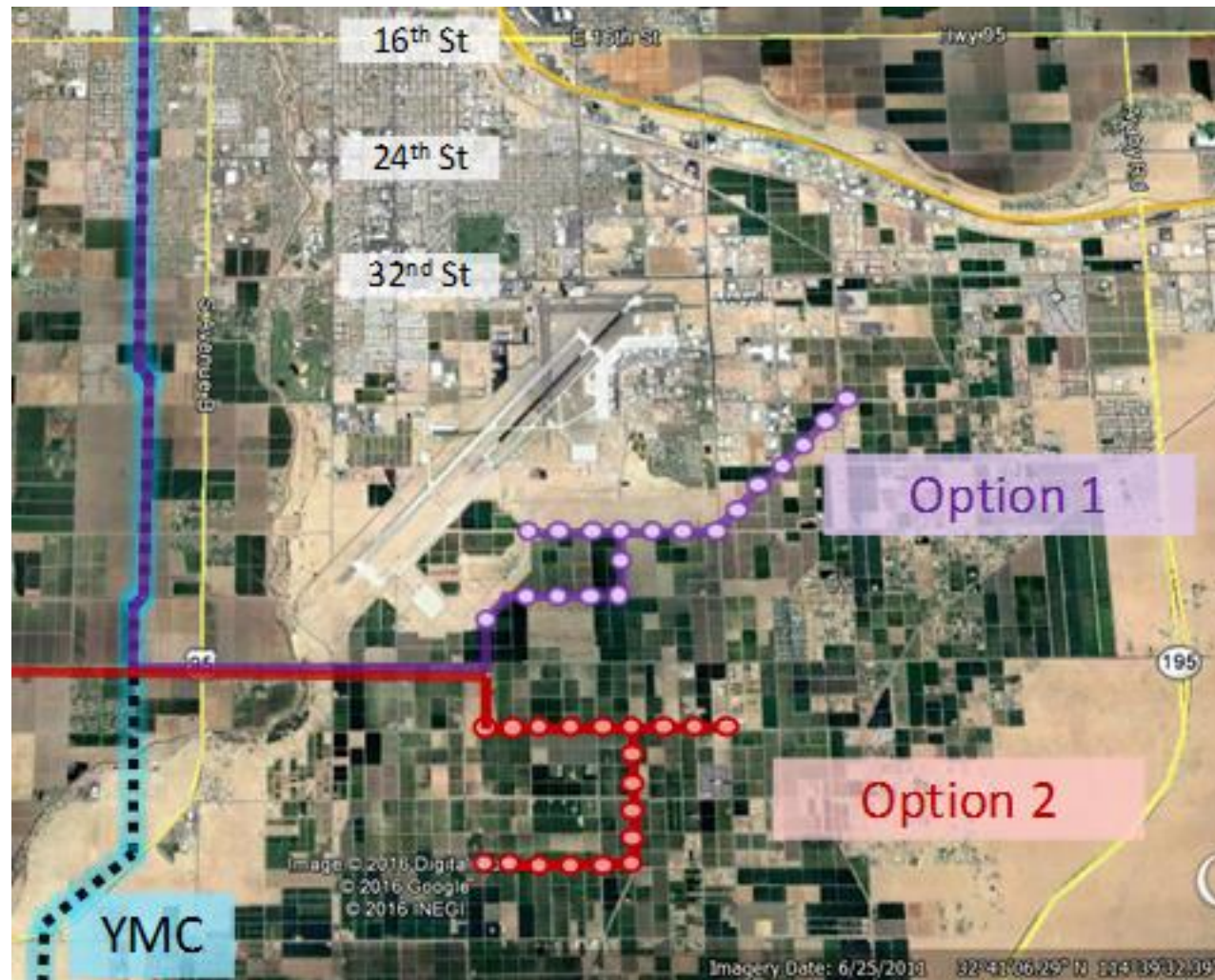
Modeled GW Elevations and Flow Paths for Proposed Conditions with 30 New Extraction Wells SE of Mound

# Concept

- Extraction
  - Wellfield Option 1 (adj. to airport, N of mound)
  - Wellfield Option 2 (brackets mound apex)
- Conveyance
  - Yuma Mesa Conduit Alignment
  - “Open Country” Alignment
  - East Main Canal Alignment
- Treatment
  - YDP mods/pre-treatment
    - Source: Yuma Mesa GW
    - Optimizing existing YDP facilities for treatment of Yuma Mesa GW
    - Open vs closed system (oxic vs anoxic)



# Wellfield Options



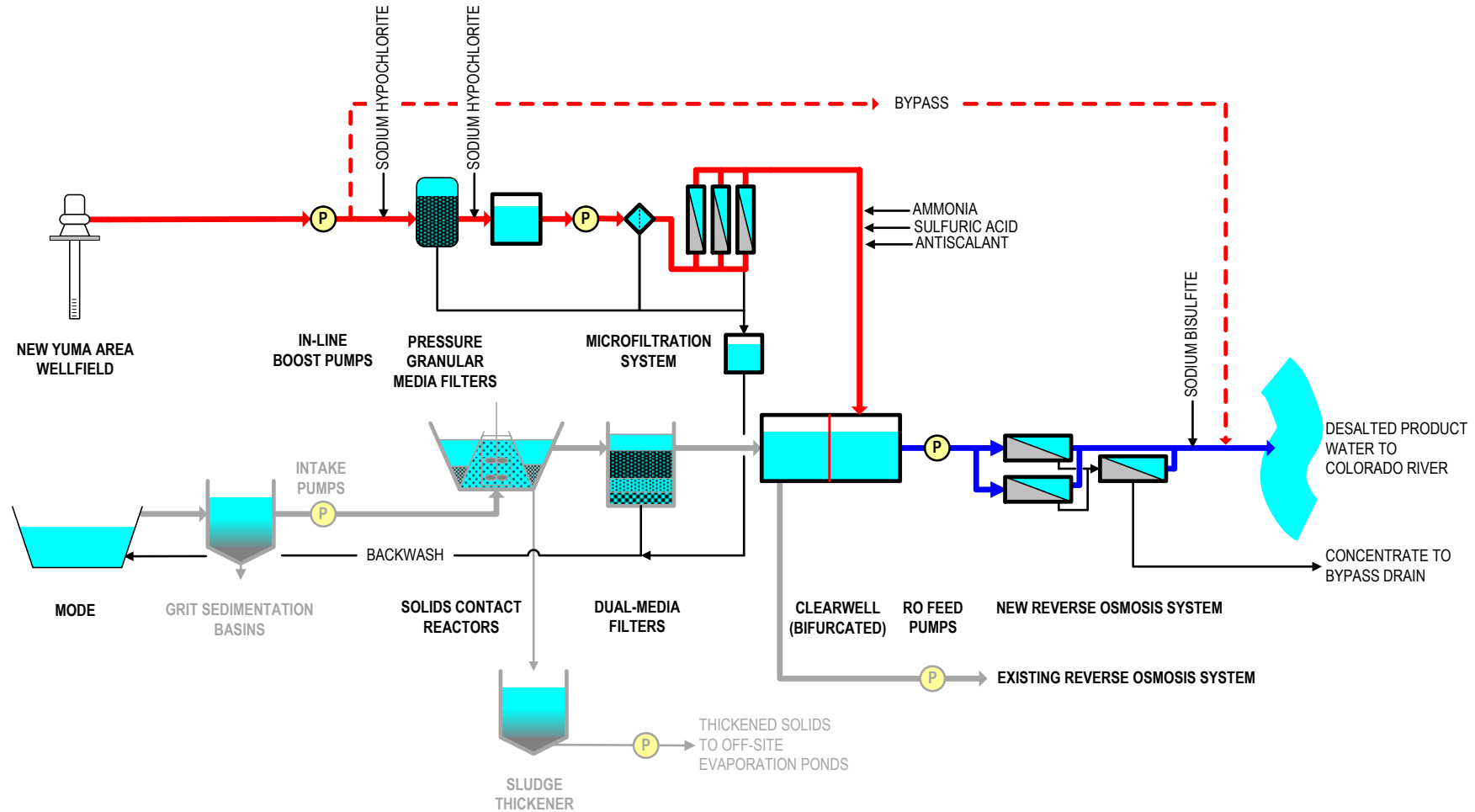
# Conveyance Options



# Treatment Considerations

- Utilize existing facilities if/when possible
- YDP source flexibility
- Capital + Annual OM costs

# Conceptual Treatment Design





# Sensitivity Analysis

- Purpose
  - Determine what effect future potential changes in Yuma Mesa irrigation rate could have on the GW mound
- Assumptions
  - Irrigation recharge: ~130,500 AF/yr
  - Pumping Rate: 53,344 AF/yr (30 wells @ 1,102 gpm)
  - Hydraulic Conductivity ( $K$ ) for all simulations
    - Upper Fine-grained Unit/Clay A/Clay B –  $10^{-6}$ -10 ft/day
    - Coarse Gravel Unit – 300-3,000 ft/day
    - Wedge Unit – 130-270 ft/day
  - Boundaries
    - E: Gila Mountains
    - S: SIB
    - W: Limitrophe
    - N: Gila River

# Sensitivity Analysis: Simulations

- Simulation 1
  - Irrigation recharge: ~130,500 AF/yr (original report)
- Simulation 2
  - Irrigation recharge: 20% reduction (focused on YMIDD area)
    - ie 130,500 AF/yr – 2% per yr for 10 yrs
    - 20% reduction by year 10
- Simulation 3
  - Irrigation recharge: 10% reduction (broad application)
    - ie 130,500 AF/yr – 1% per yr for 10 yrs
    - 10% reduction by year 10

# Sensitivity Analysis: Results

- Simulation 1

- $\Delta_{\text{mound apex elev.}}$  w.r.t current conditions: -31 ft (elev. 182' amsl)
- $\Delta_{\text{vol}}$  w.r.t current conditions: 446,350 AF
- Reduction in groundwater elevation of Yuma and Gila Valleys: 1-15'

- Simulation 2

- $\Delta_{\text{mound apex elev.}}$  w.r.t 2016 study: -15 ft
- $\Delta_{\text{mound apex elev.}}$  w.r.t current conditions: -46 ft (elev. 167' amsl)
- $\Delta_{\text{vol}}$  w.r.t current conditions: 666,850 AF
- Reduction in groundwater Yuma and Gila Valleys: 1-15' zone expanded to N and W

- Simulation 3

- $\Delta_{\text{mound apex elev.}}$  w.r.t 2016 study: -7.5 ft
- $\Delta_{\text{mound apex elev.}}$  w.r.t current conditions: -38.5 ft (elev. 175' amsl)
- $\Delta_{\text{vol}}$  w.r.t current conditions: 535,700 AF
- Reduction in groundwater elevation of Yuma and Gila Valleys: 1-15' zone intermediate expansion (> Simulation 1, < Simulation 2)

Table ES-1. Cost Summary Table

Description	Alternative 1 – Yuma Mesa Conduit Alignment	Alternative 2 – Open Country Alignment	Alternative 3 – East Main Canal Alignment
Annual Yield (ac-ft/yr)	42,865	42,865	42,865
Construction Cost	\$161,409,000	\$155,936,000	\$156,746,000
Annual O&M Cost	\$16,098,000	\$15,968,000	\$15,987,000
Net Present Value	\$479,350,000	\$471,310,000	\$472,495,000
Construction Unit Water Costs (\$/ac-ft)	\$169	\$163	\$164
Annual O&M Unit Water Cost (\$/ac-ft)	\$376	\$373	\$373
Total Unit Water Cost (\$/ac-ft)	\$545	\$536	\$537

## Notes:

All costs are presented in April 2017 dollars.

All costs were prepared in accordance with AACE International Class 4 standards, for which the estimated accuracy range is from -30 to +50%.

Nonconstruction costs for permitting, engineering, services during construction, legal, administration, and right-of-way acquisition are excluded.

Net present value was based on an annual discount rate (i) of 5 percent, annual inflation rate of 2 percent, over a period (n) of 30 years.

Unit water costs were prepared based on an annual yield of 42,865 ac-ft/yr at the YDP based on an overall system recovery of 85 percent (including bypass) to produce a final product water with TDS less than 750 milligrams per liter. Unit costs were also prepared using a capital recovery  $(A/P) = 0.0446$  where A is the equivalent annual investment and P is the initial investment. Capital recovery is calculated using the following equation:  $\frac{A}{P} = \frac{i(1+i)^n}{(1+i)^n - 1}$ .



# Summary of the Investigation

- Brackish GW under Yuma Mesa
- 50,000 AF/yr
- Total (blended) supply for exchange at a unit cost of ~\$550/AF

# Potential Next Steps

- Outreach
  - Sharing results of investigation
  - Conduct discussions with BOR and local water users to explore range of project concepts, benefits, risks, and funding options
- Potential Additional Technical Study
  - Aquifer testing
  - Pilot test
    - Phase 1 (RO pre-treatment)
      - Cartridge filtration only
      - Oxidation and cartridge filtration
      - Oxidation and membrane microfiltration
    - Phase 2
      - RO unit testing